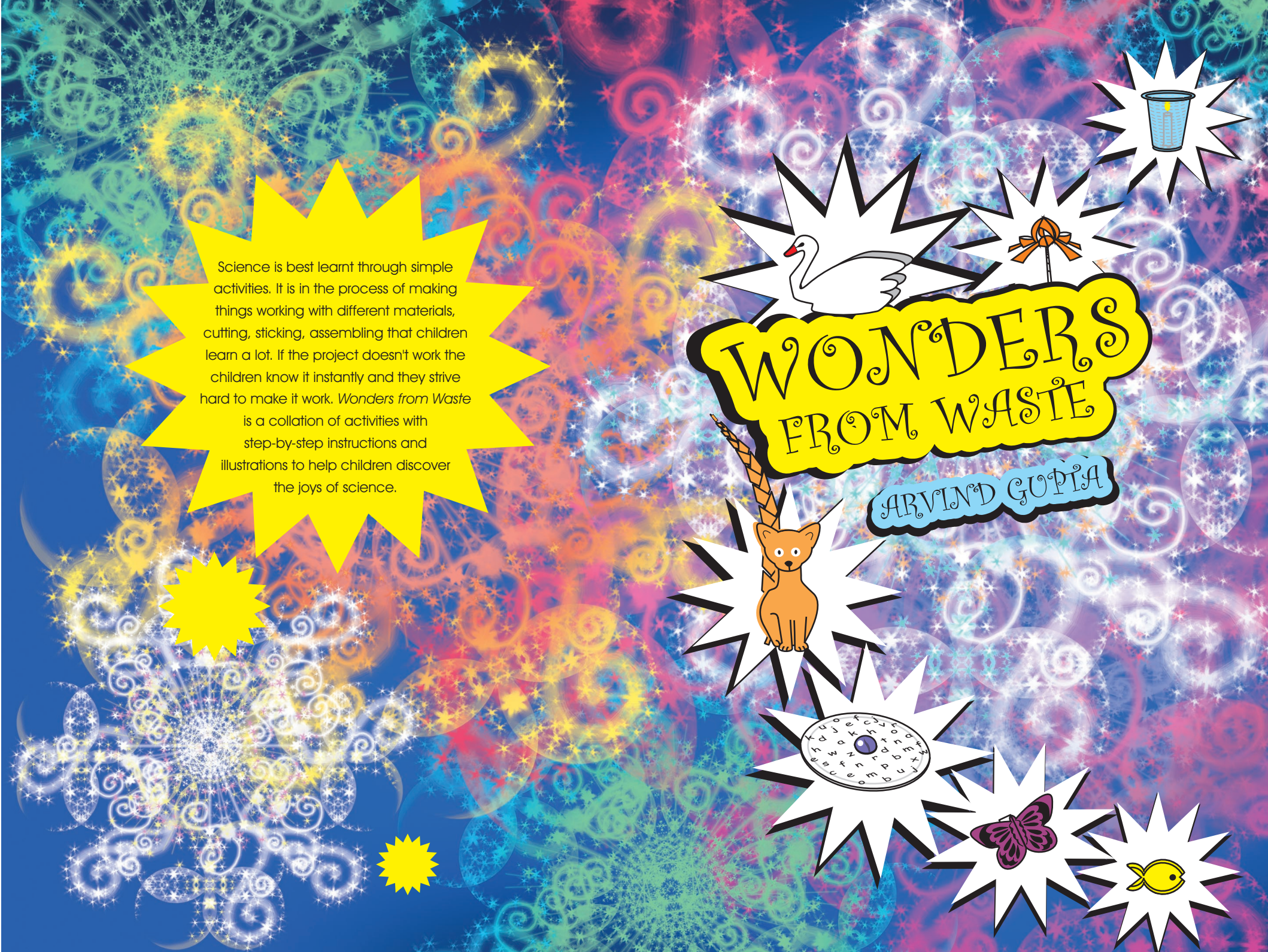
Science is best learnt through simple activities. It is in the process of making things working with different materials, cutting, sticking, assembling that children learn a lot. If the project doesn't work the children know it instantly and they strive hard to make it work. *Wonders from Waste* is a collation of activities with step-by-step instructions and illustrations to help children discover the joys of science.



ARVIND GUPTA graduated from the Indian Institute of Technology, Kanpur (1975) with a degree in Electrical Engineering. He has written 20 books on science activities, translated 150 books into Hindi and presented 125 films on science activities on *Doordarshan.* His first book *Matchstick Models & Other Science Experiments* was translated into 12 Indian languages and sold over half a million copies. He has received several honours, including the inaugural *National Award for Science Popularization amongst Children* (1988), *Distinguished Alumnus Award of IIT, Kanpur* (2000), *Indira Gandhi Award for Science Popularization* (2008) and the *Third World Academy of Science Award* (2010) for making science interesting for children.
Currently he works at IUCAA's Children's Science Centre, Pune, and shares his passion for books and toys through his popular website http://arvindguptatoys.com

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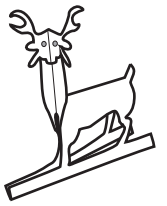
Dedicated to Avinash Deshpande, artist-activist, and a very dear friend

This book was developed under a grant from the Sir Ratan Tata Trust.

WONDERS FROM WASTE

Arvind Gupta
Illustrations by Reshma Barve

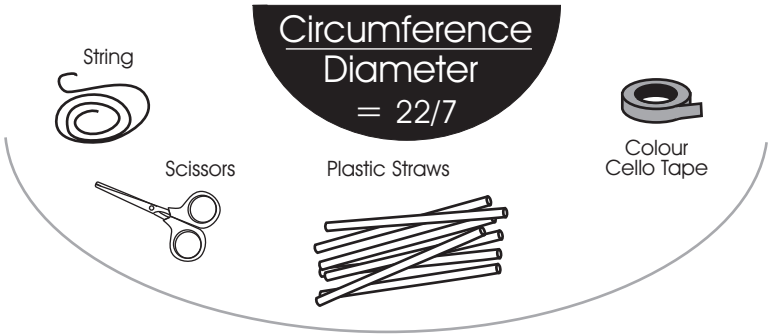


Contents

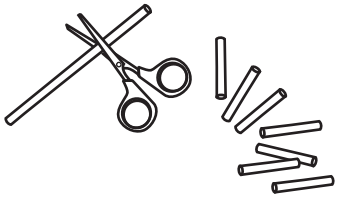
1. Circumference / Diameter 1
2. Fraction Fun 2
3. Loops to Square 3
4. Curious Rat 4
5. 3-D Buddha 5
6. Paper Deer 6
7. Paper Cup Fish 7
8. Aero Bird 8
9. Fluttering Butterfly 10
10. 3-D Pop-Up House 12
11. Paper Orchid 13
12. Secret Script 14
13. Two Blade Fan 15
14. Oil Centrifuge 16
15. Wagging Tail 17
16. Marble Swan 18
17. Magical Standing Pen.....20
18. Static Charge Bends Water 21
19. Electric Swing 22
20. Violin Generator 23
21. Inertia Pump 24
22. Toothpaste Pump 25
23. Magical Weight Gain 26
24. Hot or Cold? 27
25. Bottle Fountain 28

26. Bubbling-Up 29
27. Pull Water 30
28. Waterproof Net 31
29. Spectacular Soap Films 32
30. Stick Transmission 33
31. Lifting Jack 34
32. Tracing Path of Light 36
33. Fun with Water Lens 37
34. Add Water See Coin 38
35. Disappearing Coin 39
36. Flame in Water 40
37. Tumbler 41
38. Tipsy Bottle 42
39. Glass Lifts Glass 43
40. Vacuum Lift 44
41. Floating Candle 45
42. Convection Smoke-Flow 46
43. Stretchable Stomach 47
44. Inflatable Lungs 48
45. DNA-Helix 49
46. Peace Bomb 50

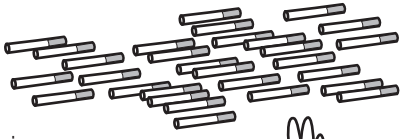
Circumference / Diameter = 22/7

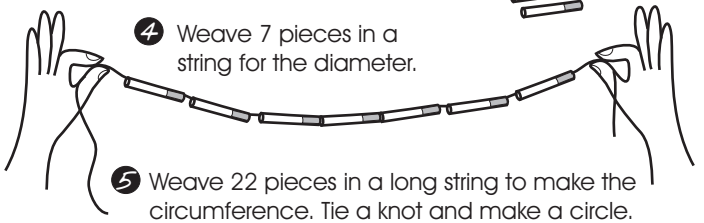


1. Cut 5 cm long pieces of straw.



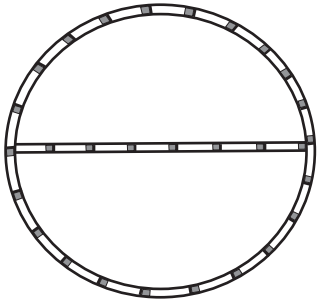
2. Cut 22 pieces for the circle's circumfrerence and 7 pieces for its diameter.
3. Mark one end of each straw with coloured tape.

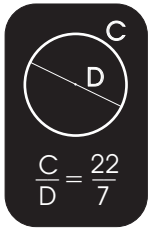




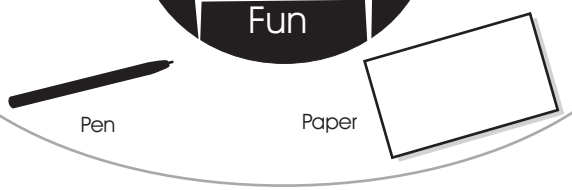
4. Weave 7 pieces in a string for the diameter.
5. Weave 22 pieces in a long string to make the circumference. Tie a knot and make a circle.

6. Tie the seven pieces along the centre.
7. The 22 pieces will mark the circumference and the 7 pieces will depict the diameter of the circle.



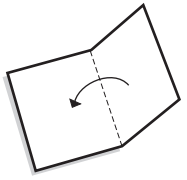


Fraction Fun

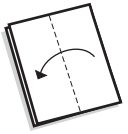


The piece of paper represents a farmer's field which has an area of 2-2/3 acres. Fold the paper to show how much will be ONE acre?

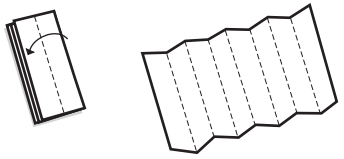
1. First fold the paper in half along its mid-line .



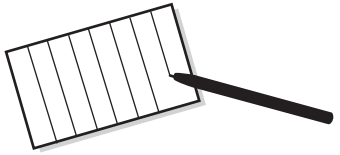
2. Fold the paper again in half to get four equal parts.



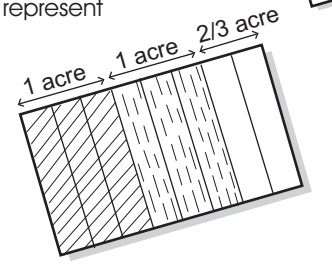
3. Fold it again in half to get eight equal parts.



4. Open and mark all eight parts.

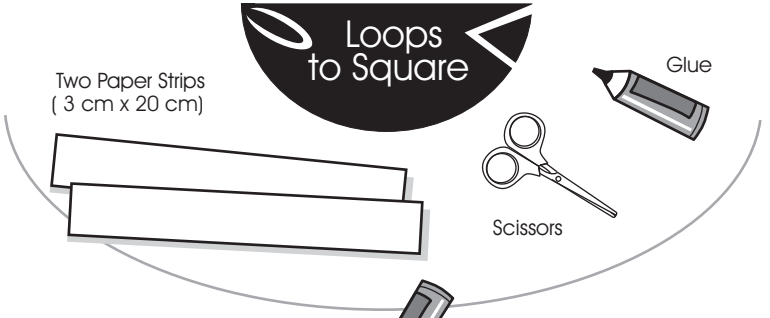


5. Shade 1 acre sections as shown. Three parts out of eight will represent 1 acre.

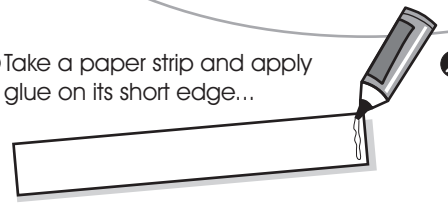


Fractions are abstract and difficult to understand. This concrete activity will help children picturize the meaning of fractions.

Loops to Square

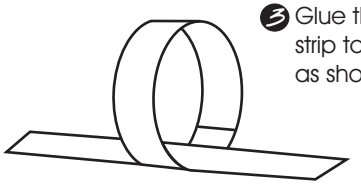


1. Take a paper strip and apply glue on its short edge...

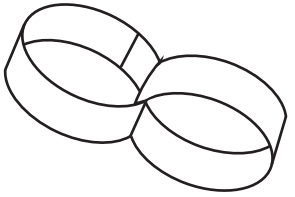


2. ... and stick it to the other edge to make a loop.

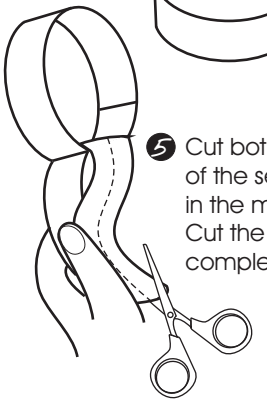
3. Glue the second strip to the loop as shown.



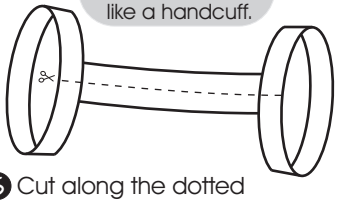
4. Glue to make the second loop.



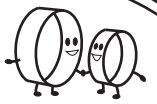
5. Cut both layers of the second loop in the middle. Cut the loop completely in half.



On opening the model will look like a handcuff.

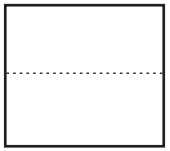


6. Cut along the dotted mid-line and you will end up with a square!

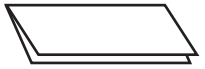


Try with smaller and longer loops.

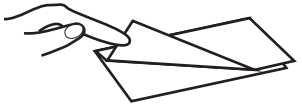
Curious Rat



1. Fold a square paper in half along its mid-line.



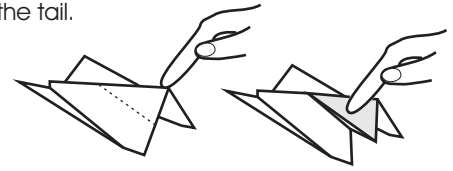
2. Fold the top layer as shown to make the left ear of the rat.



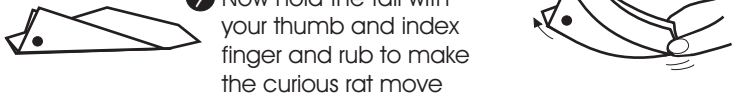
3. Upturn the paper.

4. Similarly, fold the rat's right ear.

5. Fold along the dotted line near the tail.

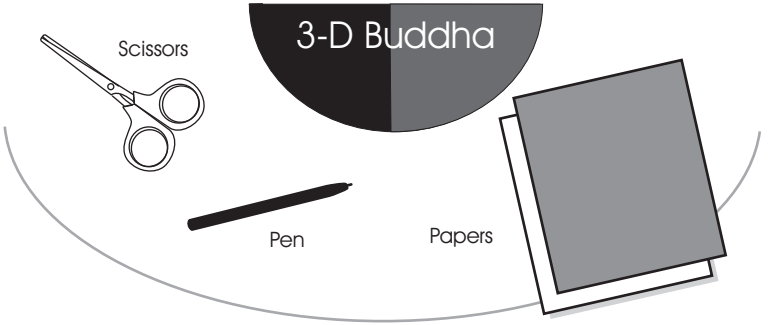


6. Reverse fold and tuck the tail triangle inwards. Draw an eye.



7. Now hold the tail with your thumb and index finger and rub to make the curious rat move from left to right.

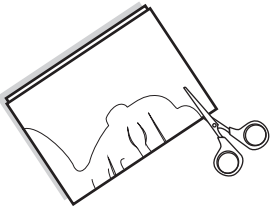
3-D Buddha



1. Take a paper and fold it in the middle.

2. Draw only half the picture of 'Buddha'.

3. Cut along the lines.



4. Lift nostrils and lips to give a 3-D shape to the Buddha.

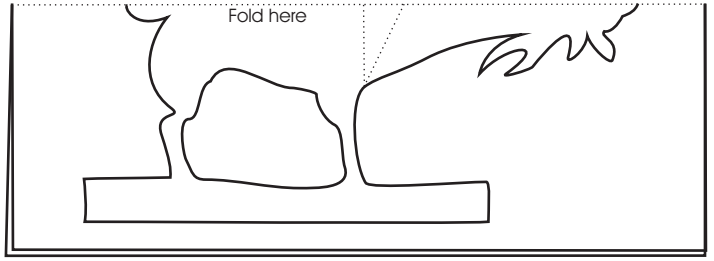
5. Stick your model on a dark paper.

Buddha's eternal sermon which has stood the test of time for over 5000 years.

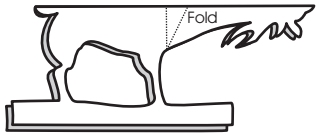
Believe nothing, merely because you have been told to. Or because it is traditional. Or because you yourself have imagined it. Do not believe what your teacher tells you... merely out of respect for the teacher.
But whatever after due examination and analysis you find, conducive to the good, and benefit, the welfare of all beings, that doctrine believe and cling to and take it as your goal.

Paper Deer

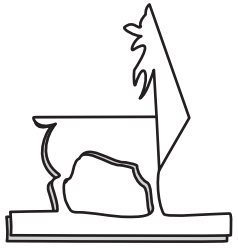
1. Fold an A-4 card sheet in half and draw half a deer as shown.



2. Cut along the outline.



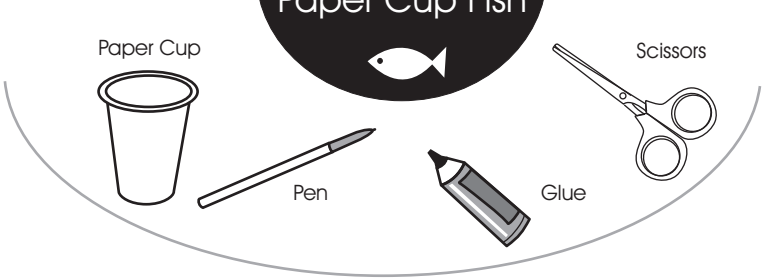
3. Fold the neck at right angles.



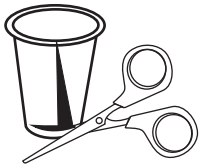
4. Reverse fold the neck and then the face...

... to see an elegant standing deer!

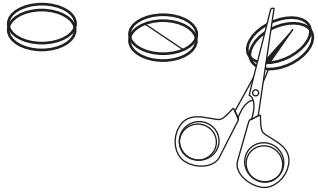
Paper Cup Fish



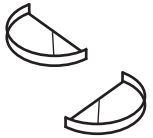
1. Cut the base of a paper cup.



2. Cut the base in two halves.

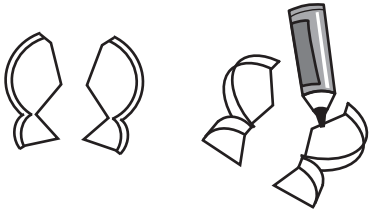


3. Draw two slant lines on the two halves.

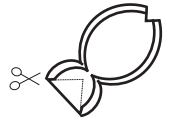


4. Cut slant lines partially as shown.

5. Bend the end triangles to make the fish's tail.

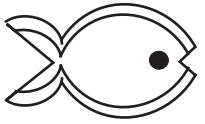


6. Glue the two halves.



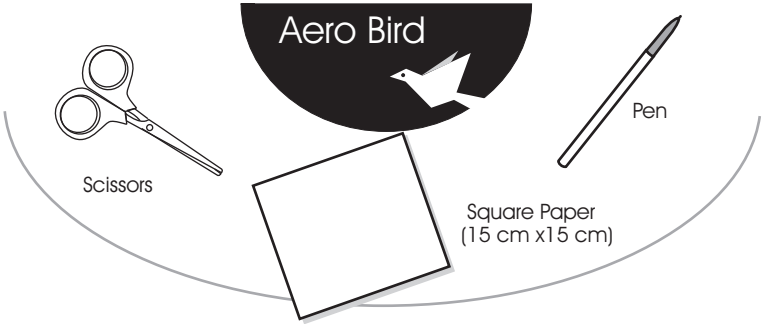
7. Cut a traingle in the tail and...

8. ...draw an eye.

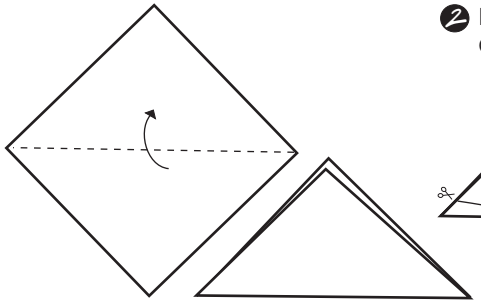


Stick this elegant fish with a magnet on the fridge or steel cupboard.

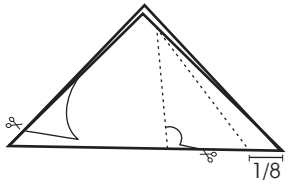
Aero Bird



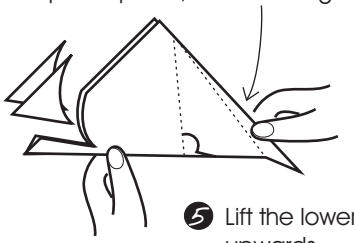
1. Take a 15 cm edge square paper and fold along its diagonal.



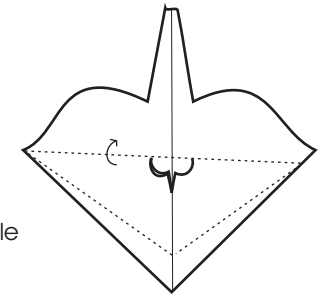
2. Mark lines as shown. Cut only the solid lines.



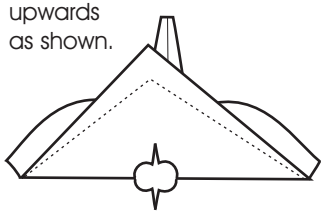
3. Fold skewed triangle to make pull flap at 1/8 from the right end.

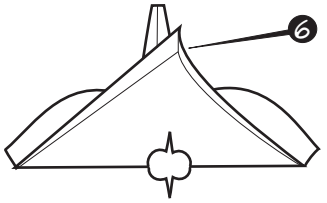


4. Open the model.



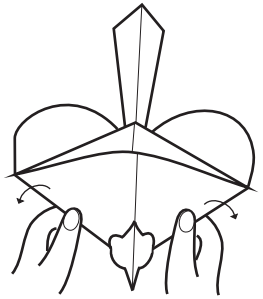
5. Lift the lower triangle upwards as shown.

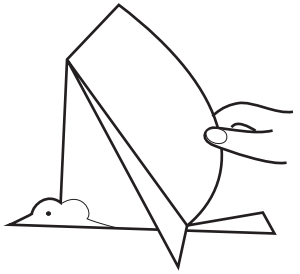




6. Pinch at this point to make a standing nose.

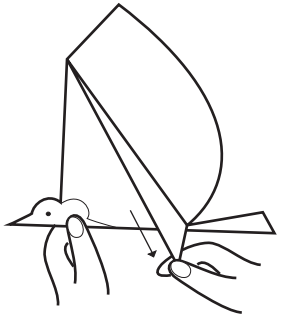
7. Fold the model in half along its backbone.





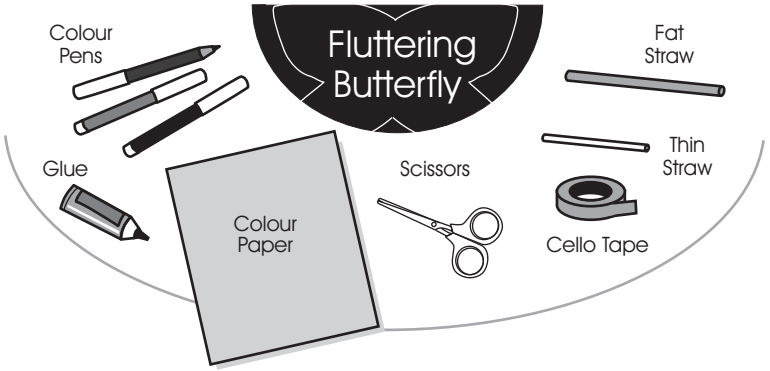
8. Draw eyes.

9. Then hold neck with one hand and pull flap downwards with the other hand to make the bird flap.

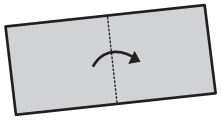


The wings are attached to the flap. On pulling the flap down the wings will also be pulled down. On releasing the flap the wings will go up again. This will make the bird flutter.

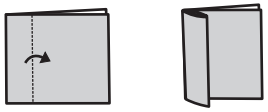
Fluttering Butterfly



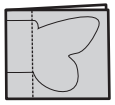
1. Take 16 cm X 8 cm colour paper and fold it in half.



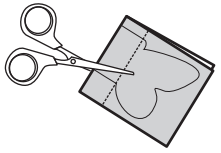
2. Fold 2 cm from the closed edge.

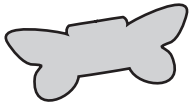


3. Open the fold and draw half a butterfly on the top side.



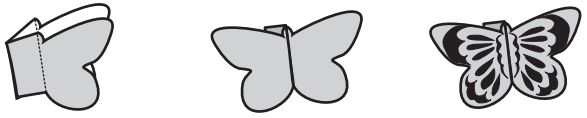
4. Cut both layers of paper along the outline.



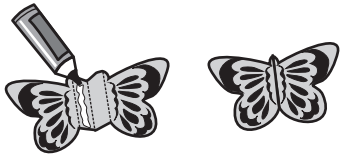


On opening the butterfly will look like this.

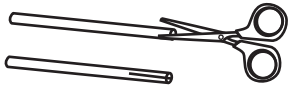
5. Bring the two wings together and press in the 2 cm fold. Decorate the wings with bright colours.



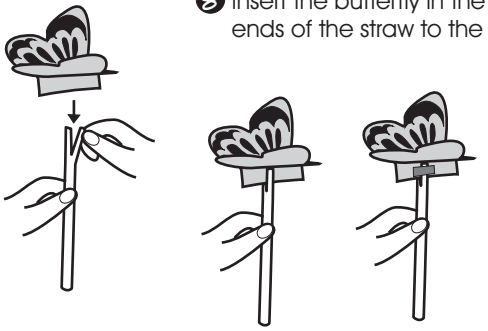
6. Glue both 2 cm layers of the fold.



7. Make a 1 cm slit in a thin straw - used in fruit juice boxes.

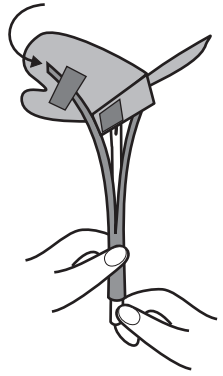


8. Insert the butterfly in the straw slit. Affix both ends of the straw to the fold with tape.

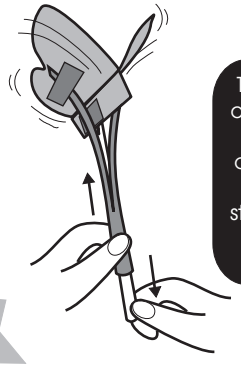


9. Make a 6 cm long slit in a fat straw. The fat straw should be shorter than the thin straw.

10. Insert the thin straw in the fat straw. Tape the two ends of the fat straw to the two wings.



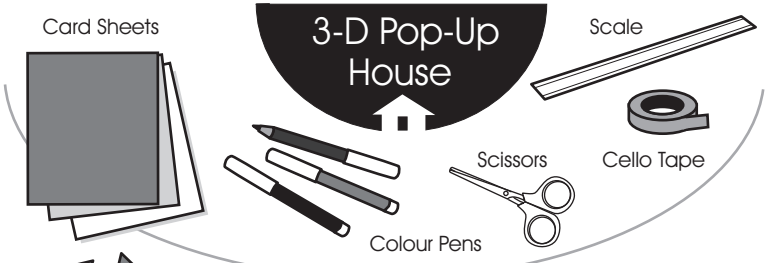
11. Now, hold the thin straw with one hand and move the fat straw up-down with the other hand.

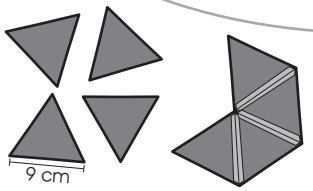


This will make the butterfly flutter its wings!

The fat straw which is attached to the wings makes a lovely coupling. The straight line motion of the straw is converted into the angular motion of the wings.

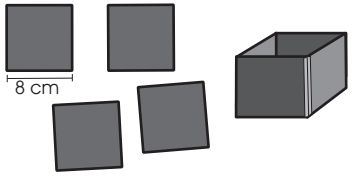
3-D Pop-Up House



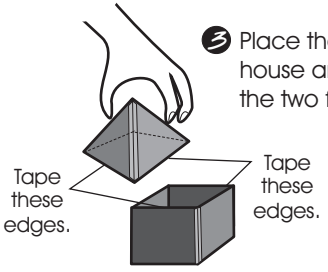


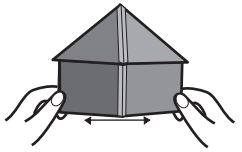
1. Draw and cut four equilateral triangles on cardsheet and stick them together with tape to make a pyramid. All joints should be flexible.

2. Draw and cut four squares for the walls of the house. Tape all joints so that they are flexible.



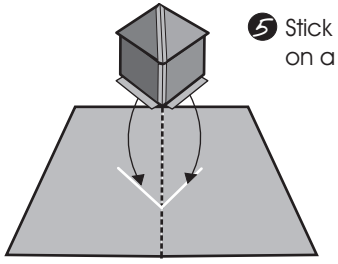
3. Place the roof on the house and tape ONLY the two front edges.



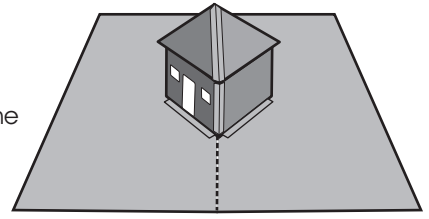


4. Collapse the house by flattening its base.

5. Stick two edges of the house with flaps on a creased folder as shown.

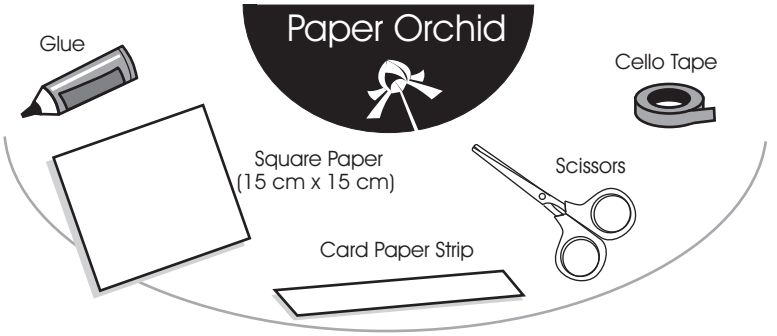


6. Stick doors and windows to complete the house.



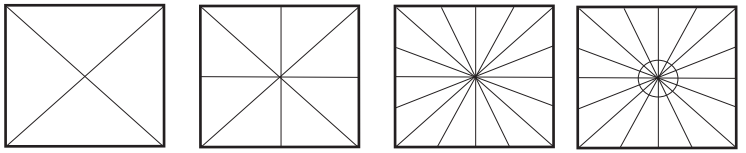
On opening the folder, the 3-D house will stand up. The house will collapse on closing the folder.

Paper Orchid

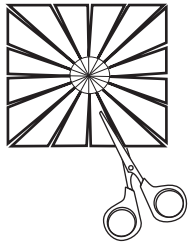


1. Take a square and divide it into 16 radial parts.

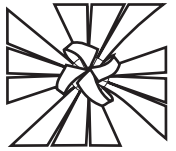
2. Draw a circle in the centre.



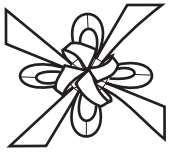
3. Cut all lines until the inner circle.



4. Tape 4 petals to make a crown.



5. Bring middle petals together and tape.



6. Roll a paper strip to make a stem.

7. Cut three sepals in the stem. Stick the stem to the flower to complete the orchid.

Secret Script

1. Write alphabets in any random order with a marker on a transparent CD.

2. Apply rubber glue along the edge of the CD hole.

3. Stick a marble in the CD hole. A little part of the marble will pop out and form the pivot for spinning.

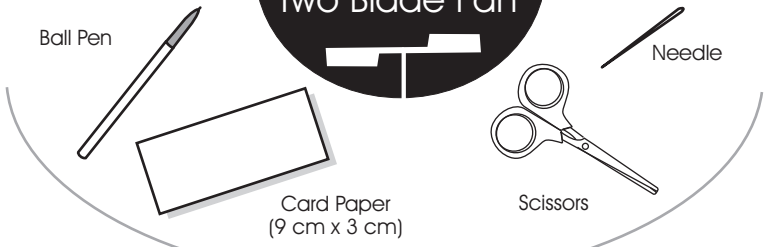
4. Write a secret message SCIENCE IS FUN on the second CD.

5. Place the marble of the first CD in the hole of the second CD. The message will be hidden.

6. On spinning the top CD, the secret message on the base CD will magically appear!

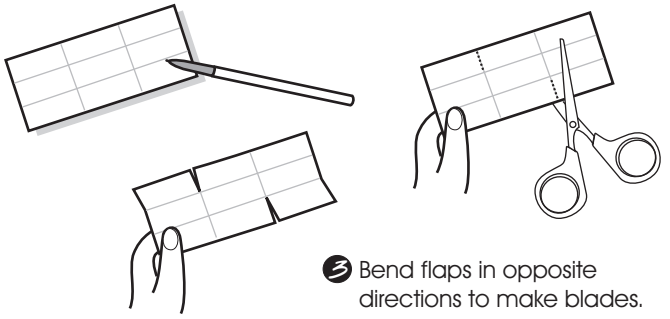
Behind the spinning blades of a ceiling fan you can see the stationary ceiling. Similarly, the stationary message becomes visible once the top CD spins.

Two Blade Fan

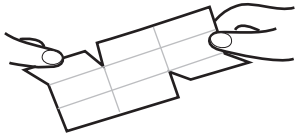


1. Mark nine equal parts on the card paper as shown.

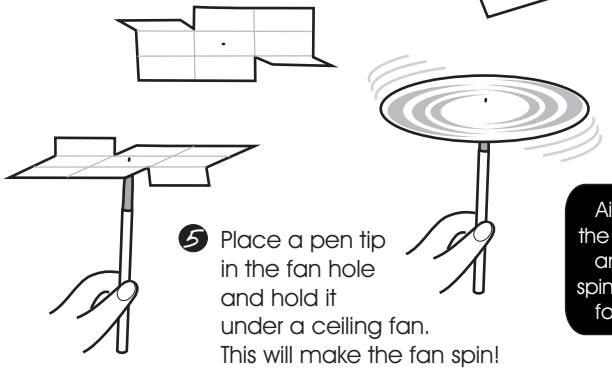
2. Cut along the two dotted lines.



3. Bend flaps in opposite directions to make blades.



4. Make a small hole in the center.



5. Place a pen tip in the fan hole and hold it under a ceiling fan. This will make the fan spin!

Air will strike the fan blades and this will spin it at a very fast speed!

Oil Centrifuge

Bowl with three strings attached

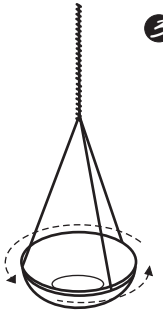
Colour Water

Edible Oil

Cycle Ball Bearings

1. Tape a bowl with three strings so that it can hang freely.

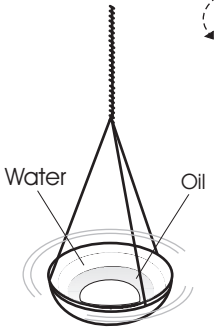
2. Spin the bowl to twist the threads completely.



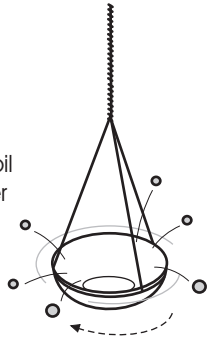
3. Place ball bearings in the bowl and then ...

4. ...leave the bowl to spin freely.

5. The string will unwind and the balls will spill and scatter because of the force of spin.



Pour 20 ml water and 10 ml oil in the bowl. As you spin, water will be thrown out and oil will stay inside.



This is the model of a simple centrifuge. As you spin, water being denser, will be thrown out. Oil being lighter will stay inside.

Wagging Tail

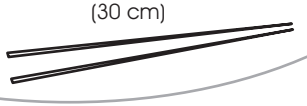
Xerox Paper

Card Sheet

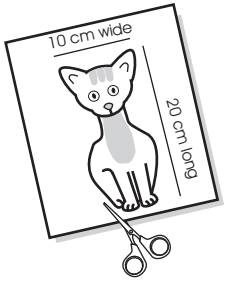
Scissors

Cello Tape

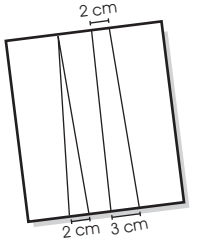
Two Broomsticks (30 cm)



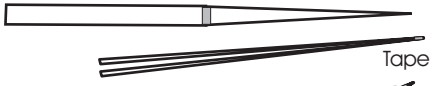
1. Draw and cut a cat from a card sheet.



2. Draw two tapered lines on a xerox sheet as shown.



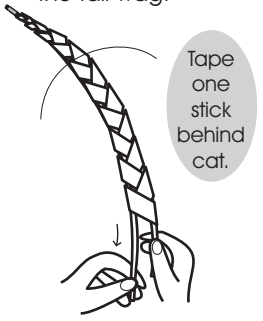
3. Cut both strips and stick them with tape to make a long tapered strip.



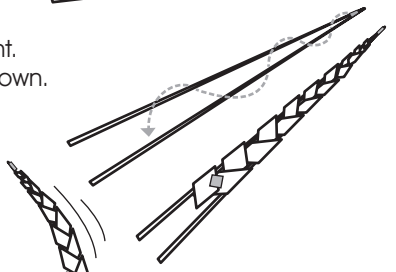
4. Tape the thin ends of two broomsticks together.

Tape

5. Tape the narrow end of the paper strip to the broomstick joint. Weave the strip alternately as shown. Hold the left stick and move the right stick up-down to make the tail wag!

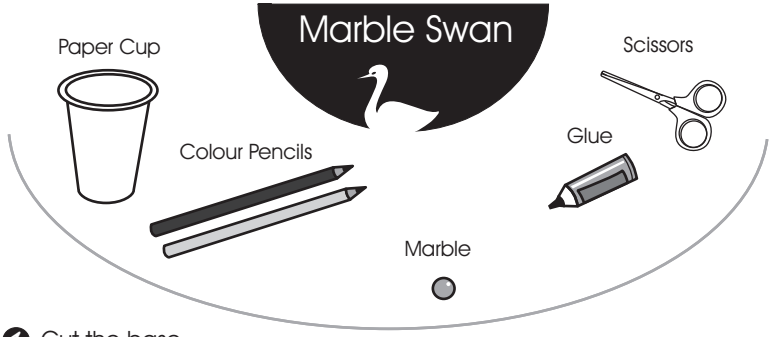


Tape one stick behind cat.

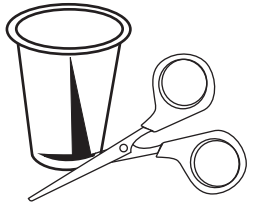


6. Hold the cat with one hand and push-pull the free stick to make the cat's tail wag!

Marble Swan

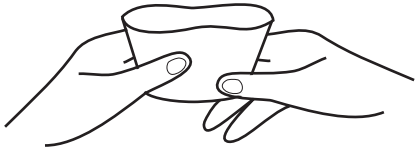


1. Cut the base of a paper cup.



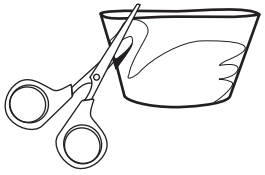
2. Also cut the rim of the cup.

3. Flatten the cup to double it...

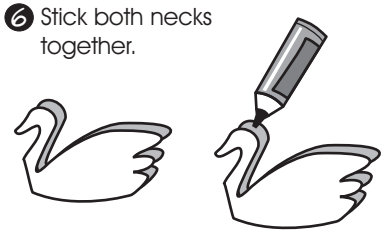


4. ... and draw a swan on the cup.

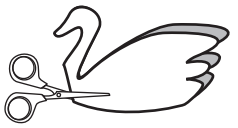
5. Cut the outline of the swan.



6. Stick both necks together.



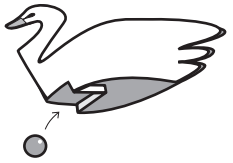
7. Cut a 2 cm notch near the base.



8. Reverse fold the cut portion to make a diamond shaped space.

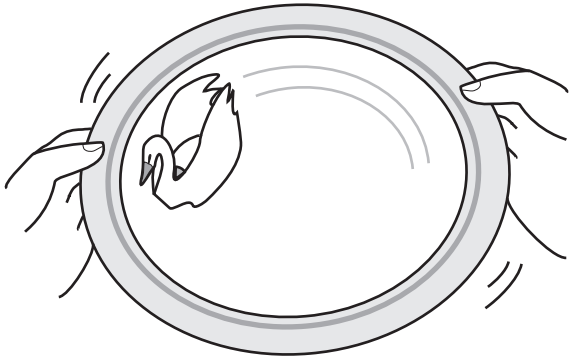
9. Colour the beak and eye. Decorate the swan.

10. Place the marble in the diamond space...

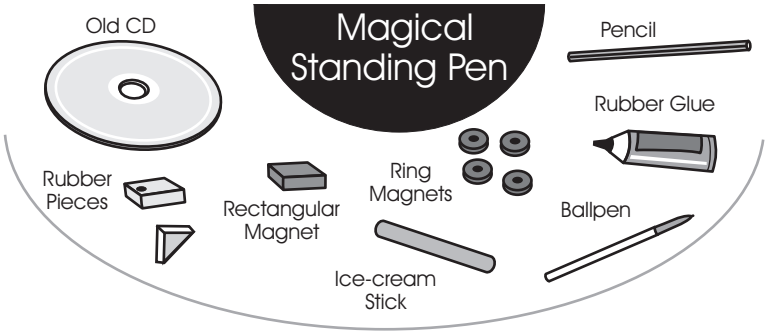


11. ...and place the swan on a plate. Keep tilting the plate to make the swan glide round and round.

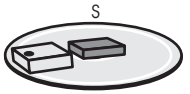
Because of low friction the marble will roll freely on the plate. The rolling marble will carry the light weight structure of the swan along with it.

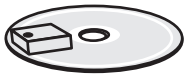


Magical Standing Pen

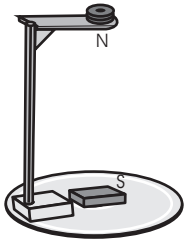


1. Make hole in the rubber piece and stick it on a CD.





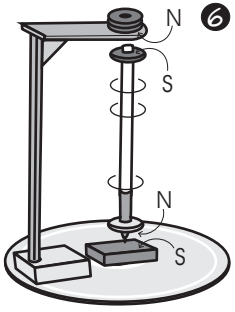
2. Stick a rectangular magnet at the centre with rubber glue. Its South pole should be facing up.



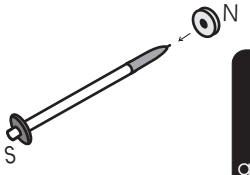
3. Stand a pencil in the hole of the rubber piece. Fix it in place with rubber glue.

4. Stick half an ice-cream stick to the pencil on top. Stick a rubber triangle for support and strength.

5. Stick two ring magnets on top of the ice-cream stick. Their North poles should point downwards.



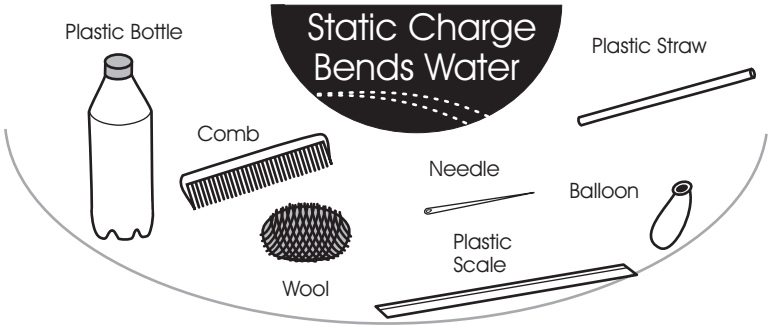
6. Insert ring magnets on both ends of a pen. Their polarities are shown in the picture. The magnets on the pen will be attracted both to the top and the base magnets.



This model is based on the basic principle of magnetism - that LIKE poles repel and UNLIKE poles attract.

7. Place the pen tip on the base magnet. The pen will stand erect. Twirl it to keep it spinning!

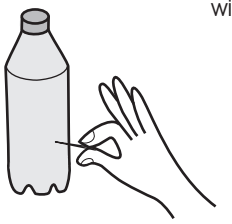
Static Charge Bends Water

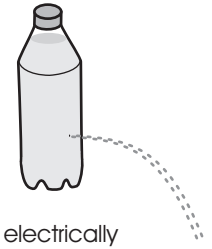


1. Fill bottle with water and screw the lid.

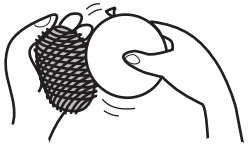
2. Poke a small hole near the base of the bottle with a needle.

3. On removing the lid, a thin stream of water will flow out from the hole.

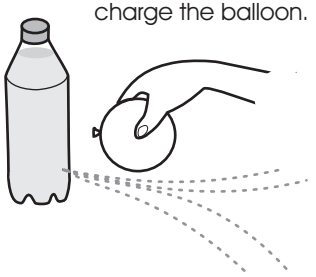




4. Rub an inflated balloon with wool.



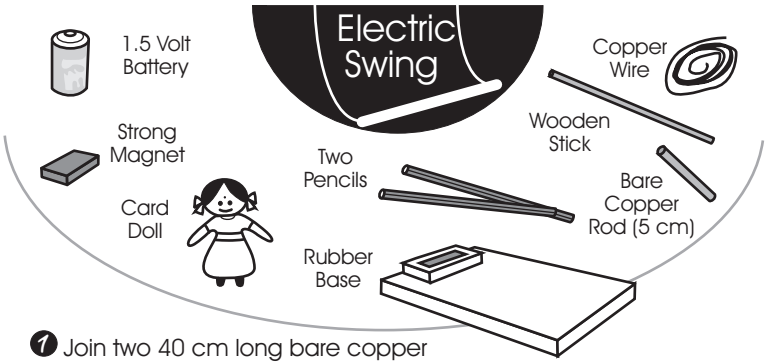
5. This will electrically charge the balloon.



On rubbing the balloon with wool, some of its electrons get knocked off giving the balloon an electric charge. The thin stream of water is attracted to the charged balloon.

Then bring the balloon close to the water stream. The stream will be attracted to the charged balloon. Repeat the experiment using a comb, plastic scale and a straw.

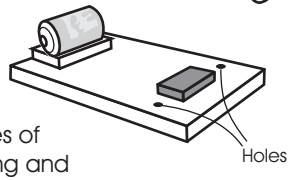
Electric Swing



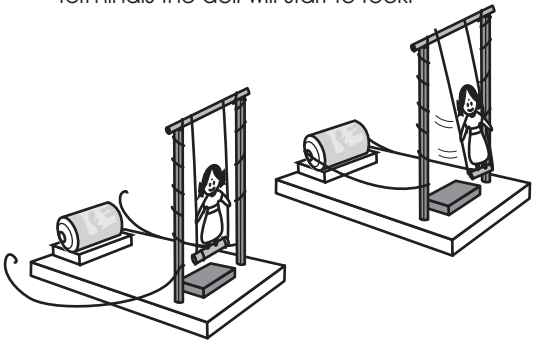
1. Join two 40 cm long bare copper wires to the two ends of a 5 cm long bare copper rod.

2. Hang the wires on an inverted U-shaped swing made from two pencils and a stick.
3. Glue the doll to the copper rod seat.

4. Stick a strong magnet and place a battery on the rubber base as shown.

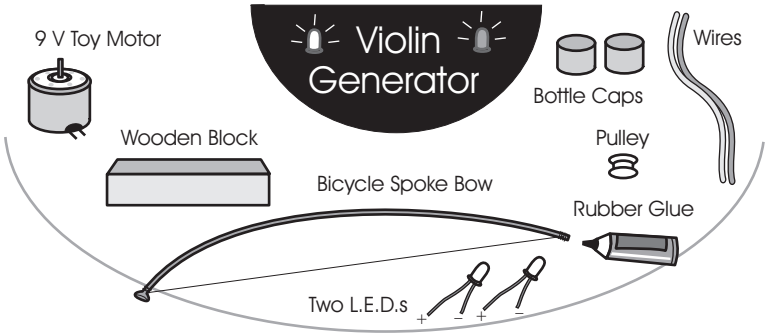


5. Stand the swing in the two holes of the rubber base. On connecting and disconnecting the wires to the battery terminals the doll will start to rock.



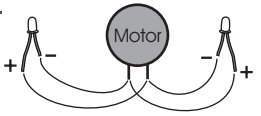
When current passes through the copper rod it becomes an electro-magnet and is attracted to the permanent magnet. The repeated on-off current makes the doll swing.

Violin Generator

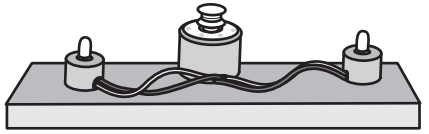


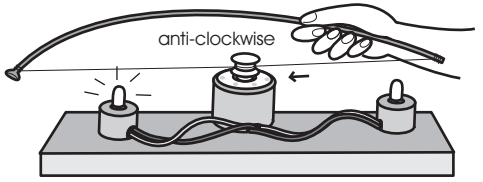
1. Fix a pulley on the motor shaft.

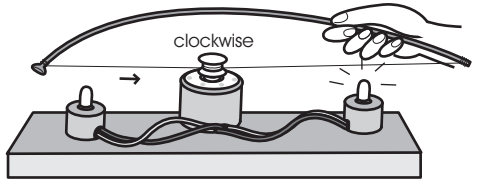
2. Make holes in two bottle caps and mount L.E.Ds.
3. Attach the two L.E.Ds to the motor terminals as shown.



4. Fix the motor and L.E.Ds on a wooden base. On flicking the pulley clockwise the left L.E.D. will light. On flicking the pulley anti-clockwise the right L.E.D. will light.
5. Use a string bow to spin the pulley continuously. Move bow back and forth to see L.E.D.s glow alternately.

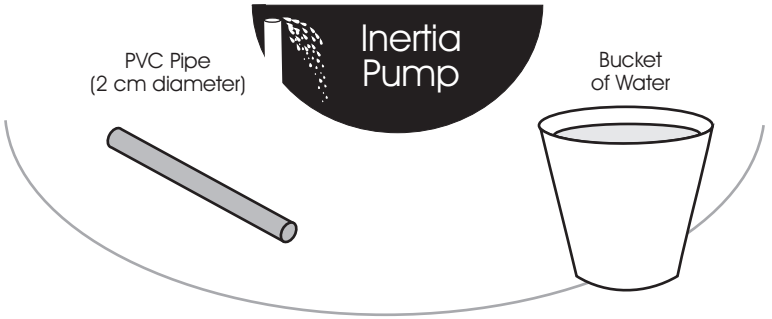




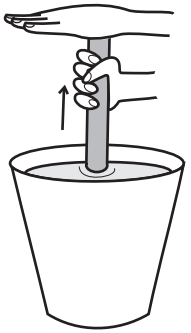


The motor produces Alternating Current. On the other hand the L.E.D.s run only on Direct Current. They light up only when current flows in a particular direction.

Inertia Pump

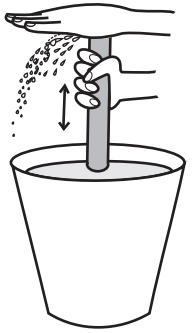


1. Take a 50 cm long PVC pipe used for household electrical wiring. Smoothen its ends by rubbing on sand paper.



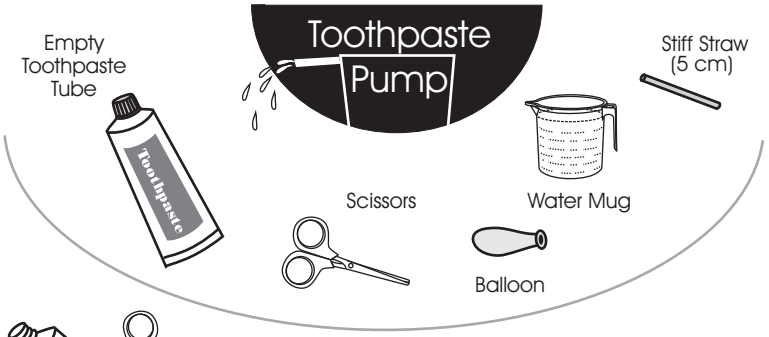
2. Hold the pipe with your left hand and move it up-down in a bucket of water. Keep the palm of your right hand on top of the pipe and open-close it like a hinge. Soon water will start squrting out.

3. The up-down motion of the left hand does the pumping while the right hand acts like a valve. The use of the palm gives an excellent physical feel for a valve.



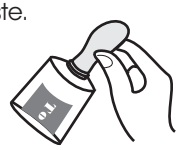
When the pipe is plunged in water, a bit of water rises in the pipe. As the palm is lifted and the pipe is open, air is expelled. Once the palm shuts the top, the water which has risen cannot go down. With every stroke, a little water rises in the pipe and finally squirts out.

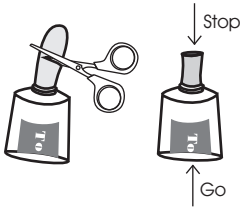
Toothpaste Pump



1. Cut an empty toothpaste tube 4 cm from the open end. Wash well to remove any sticking toothpaste.

2. Fix a balloon on the threaded mouth of the tube.

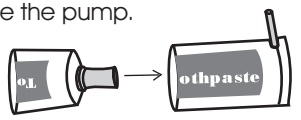




3. Cut the balloon as shown. The cut balloon will act like a valve.

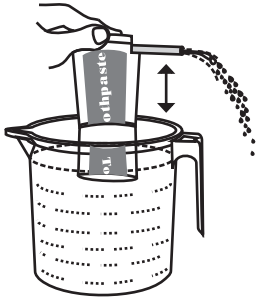
4. Make a hole near the closed end of the tube. Insert a stiff straw in the hole as the delivery pipe.

5. Insert the balloon valve in the open tube. This will complete the pump.

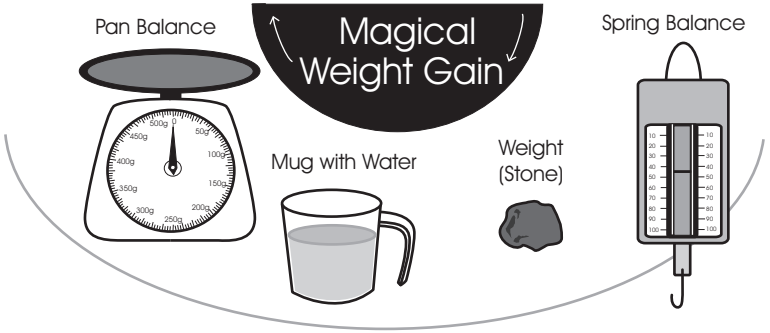


The cut balloon will act like a valve. There will only be one way traffic. Water will flow upwards from below but not the other way round.

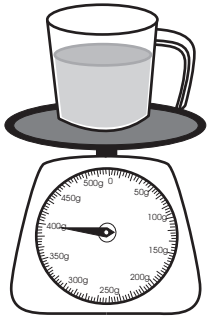
6. Hold the pump vertically and move it up-down in a mug of water. After a while, water will squirt out from the delivery pipe.



Magical Weight Gain



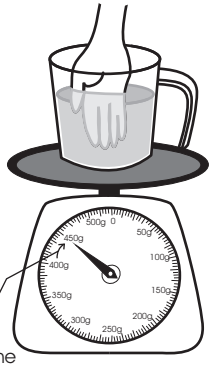
1. Place a water mug on a pan balance.

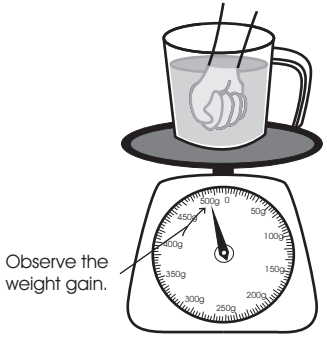


2. Dip your fingers in water without touching the mug.

The increase in the pan balance reading will be equal to the weight of the water displaced by the fingers.

By dipping the fingers there is a weight gain of 50 g.





3. Now clench your fingers in a tight fist and again dip it in water without touching the mug. Because the fist occupies more volume than the fingers, the weight gain will be more.

By dipping the fist there is a weight gain of 100 g.

4. The mug of water weighs 400 g. The stone hung in air weighs 65 g. Now dip the stone in water without touching the mug. The pan balance will now read 420 g. The spring balance will read 45 g.

This time, the increase in the weight on the pan balance (20 g) will be equal to decrease in the weight on the spring balance (20 g).

Reading on pan balance: 420 g
Reading on spring balance: 45 g

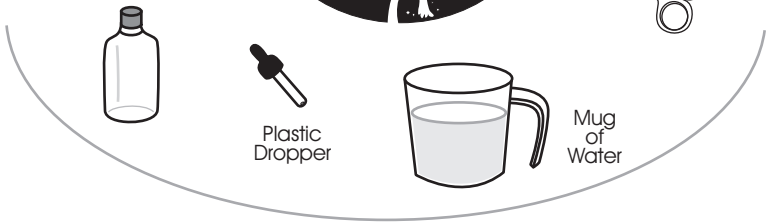
This is based on Archimedes Principle - the upthrust or buoyant force will be equal to the weight of the displaced water.

Hot or Cold?

1. Take three glasses, one with hot water, another with very cold water and the third with water at room temperature.
2. Then put one finger in the hot and the other finger in the cold water. Keep them for a minute.
3. Then put both the fingers in the middle glass.

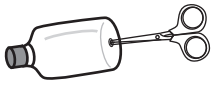
You will find that the water is warm to the finger that was in the cold water, but is cold to the finger which was in the hot water.

Bottle Fountain

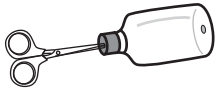


1. Remove the rubber cap from the dropper.

2. Make a hole in the base of a small bottle.



3. Make another hole in its lid.

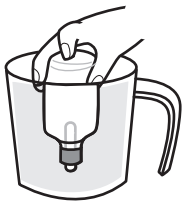


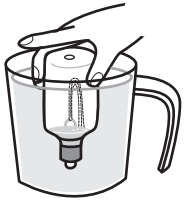
4. Tightly fit the dropper tube in the bottle cap.

5. Shut the base hole with your finger and invert the bottle in a jar of water.

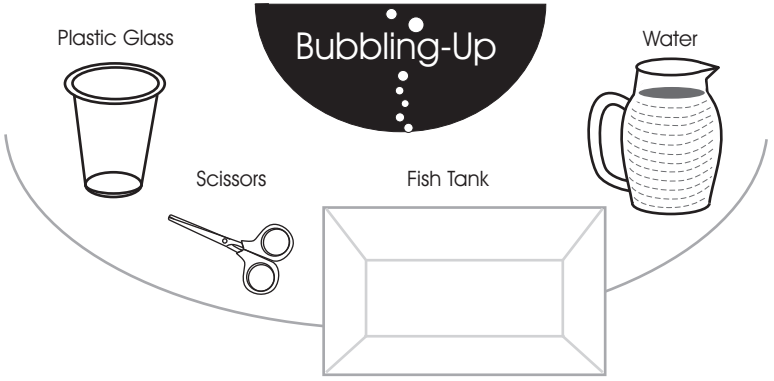
When the bottle is dipped in water the pressure near its lid is high. So, on opening the base hole water gushes in like a fountain.

6. Open the base hole to see a fountain gushing inside the bottle.

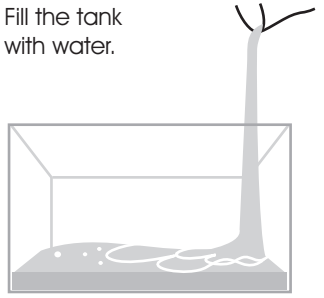




Bubbling-Up

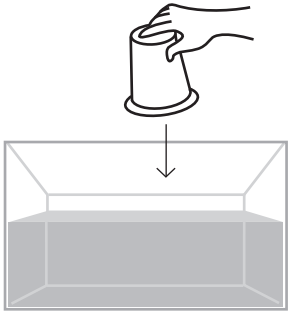


1. Fill the tank with water.

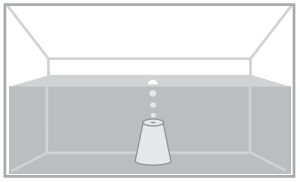


2. Make a 8 mm hole in the base of a plastic glass.

3. Close the hole with your finger and push the glass towards the base of the fish tank. The glass will stick to the base like a suction cup.

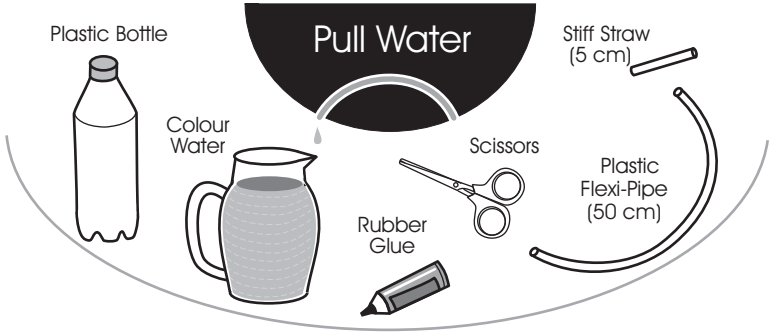


4. On removing the finger, water will enter the empty glass through the hole and air bubbles will start coming out. This will continue until the glass is filled with water. Then the glass will float-up to the top.



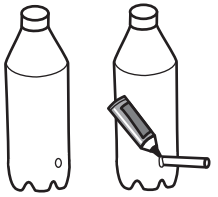
On pressing some of the air from the glass is expelled. This creates a partial vacuum and the glass sticks to the fish tank like a suction cup.

Pull Water



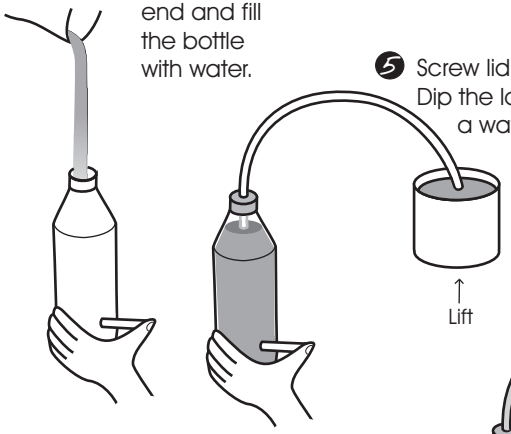
1. Make a hole in the bottle lid with the scissors and press fit a flexi-pipe in the lid.

2. Make a hole near the bottle base.



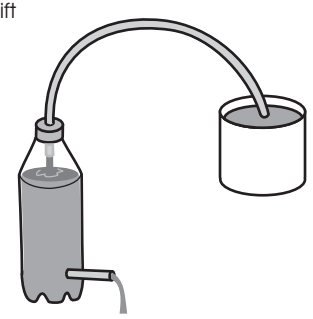
3. Press fit a 5 cm stiff straw in the hole. Seal the joint with rubber glue.

4. Close straw end and fill the bottle with water.



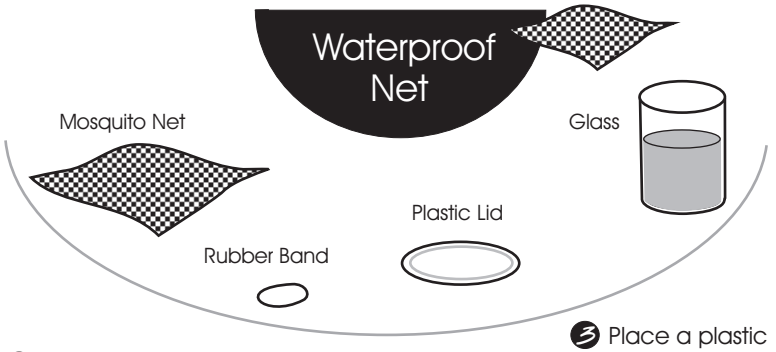
5. Screw lid with pipe on bottle. Dip the loose end of the tube in a water jar.

This is a novel way of making a simple siphon.



6. Raise the jar and open the end of the stiff straw. Colour water will be sucked up from the jar through the flexi-pipe. Slowly, all the water will be drained out.

Waterproof Net



1. Place the net on a glass and secure it with a rubber band.

2. Fill the glass to the top with coloured water.

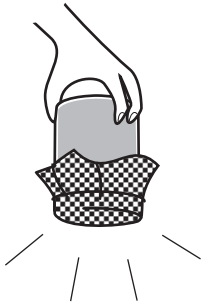
3. Place a plastic lid on top of the glass.

4. Then invert the glass and slowly slide the lid away.

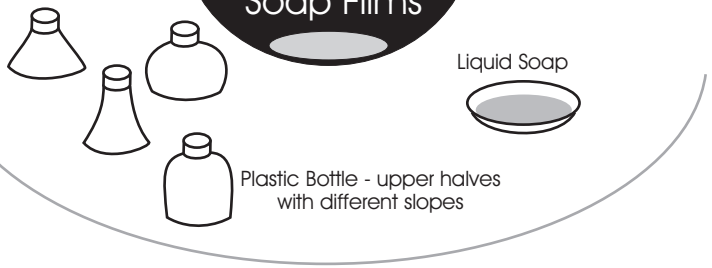
Though the glass is covered with a net full of holes, water will NOT FALL .

The surface tension gives the water surface an invisible skin. The downward force is unable to push water through the small holes of the netting.

5. You can repeat the experiment with the glass only partly filled with water.



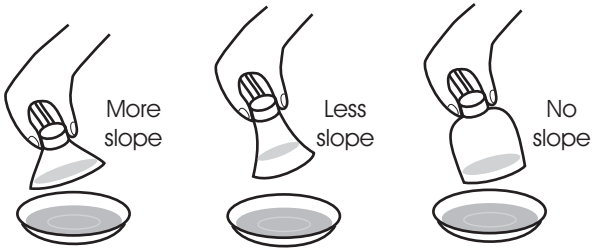
Spectacular Soap Films



1. Take a cut bottle and dip it in soap solution. The bottle should not have a lid.

2. Lift the bottle and tilt it slightly. Observe the film carefully. The film will travel up because of surface tension.

Try this experiment with different bottles having various gradients.

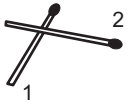


Film travels fast | Film travels slowly | Film stays at one place

In trying to minimise its surface area the soap film will travel towards the narrow end. The more the slope, the faster its speed.

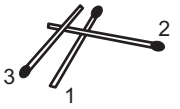
Stick Transmission

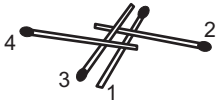
1. Arrange matchsticks as shown.



2. Place 2 across 1.

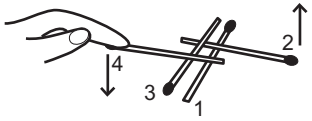
3. Place 3 across 2.





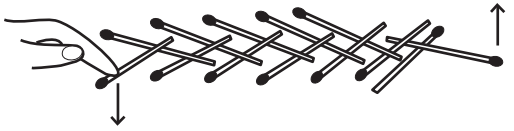
4. Place 4 across 3 and 1.

5. Now, repeatedly press and release matchstick 4.



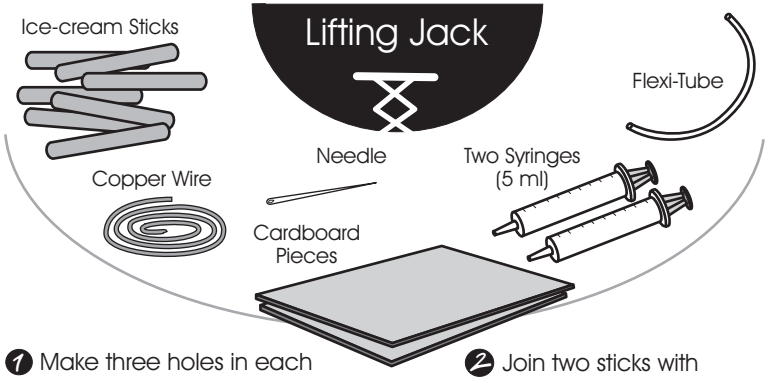
This will make matchstick 2 lift and fall.

6. Increase the length of the chain by placing more sticks in a similar manner. On pressing the last matchstick, the first matchstick will lift.

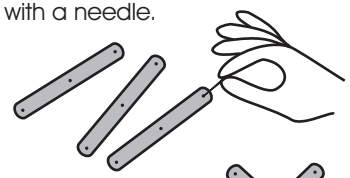


In this chain of matchsticks each one is linked to the other. On pressing the last matchstick force will be transmitted through a series of fulcrums and the first stick will lift.

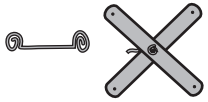
Lifting Jack



1. Make three holes in each stick with a needle.

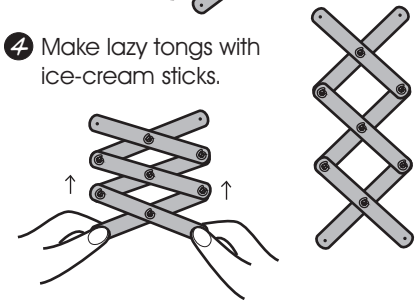


2. Join two sticks with copper wire.



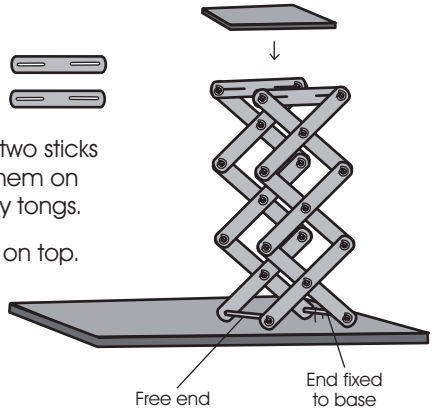
3. Bend copper wire ends into loops as stoppers.

4. Make lazy tongs with ice-cream sticks.



The lazy tongs can stretch and shrink.

5. Join two lazy tongs together at the base with cross sticks.

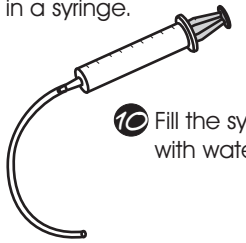


6. Make slits on two sticks and attach them on top of the lazy tongs.

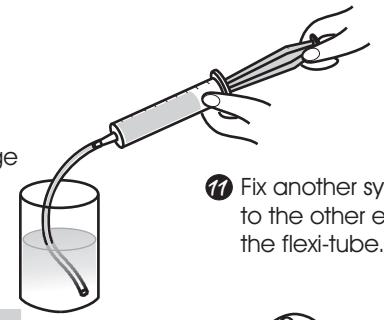
7. Stick a cardboard platform on top.

8. Fix the assembly on a cardboard base. One end of the tongs should be free and other fixed.

9. Press fit a flexi-tube in a syringe.

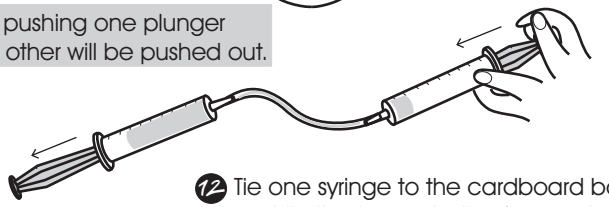


10. Fill the syringe with water.

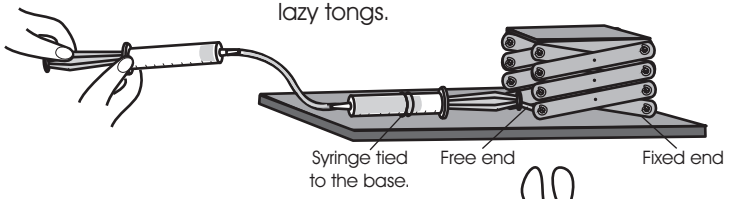


11. Fix another syringe to the other end of the flexi-tube.

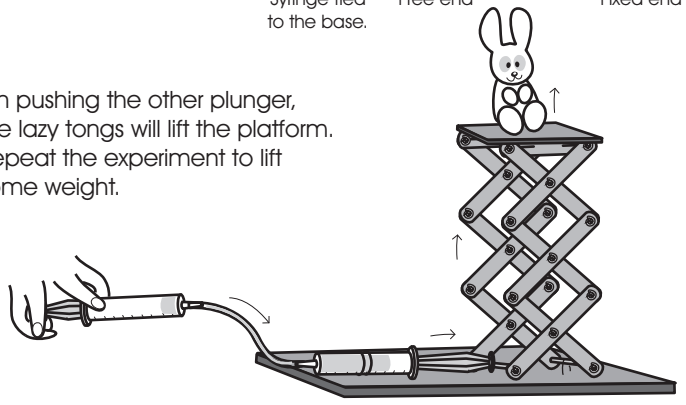
On pushing one plunger the other will be pushed out.



12. Tie one syringe to the cardboard base and tie its plunger to the free end of the lazy tongs.



13. On pushing the other plunger, the lazy tongs will lift the platform. Repeat the experiment to lift some weight.

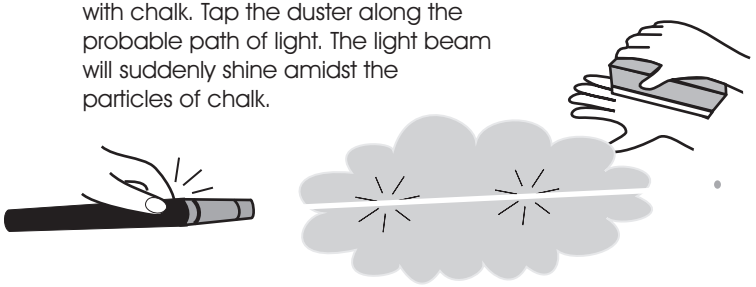


Water is an incompressible fluid. When pushed through one syringe water transmits the pressure to the other syringe without getting compressed.

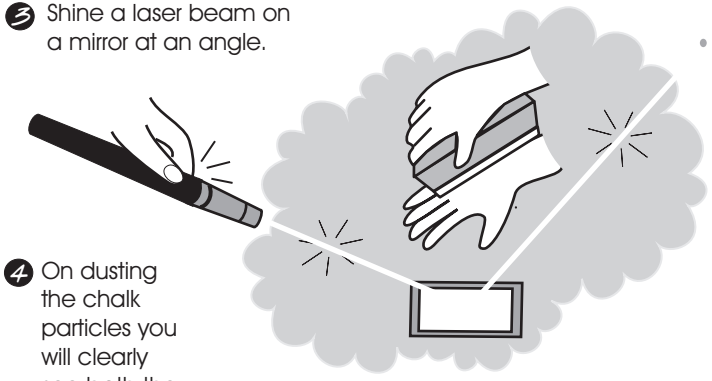
Tracing Path of Light

1. On shining a laser pointer you will see a point of light on the wall. But the actual path of light will remain invisible.

2. Now take a blackboard duster laden with chalk. Tap the duster along the probable path of light. The light beam will suddenly shine amidst the particles of chalk.



3. Shine a laser beam on a mirror at an angle.



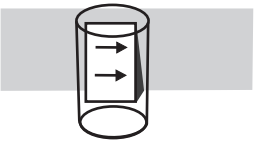
4. On dusting the chalk particles you will clearly see both the incident and the reflected rays.

A beam of light in air is invisible. Dust and chalk particles scatter light and make the beam visible.

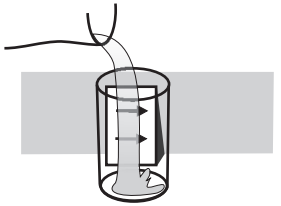
Fun with Water Lens

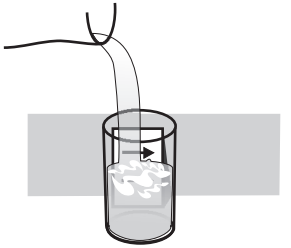
1. Place the arrow card near the wall.

2. Place a glass infront of the card.

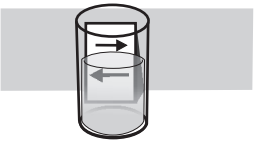


3. Fill water in the glass to cover the lower arrow.





4. Magically, the lower arrow will reverse direction and appear larger.

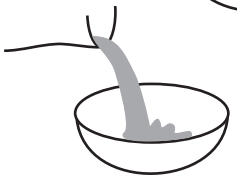


On pouring water in the glass, it acts like a convex lens and inverts the direction of the arrow.

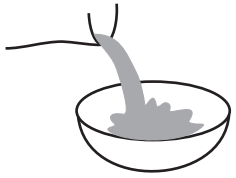
Add Water See Coin

1. Place a coin in the bowl.

2. Move a little away from the bowl until the coin disappears.

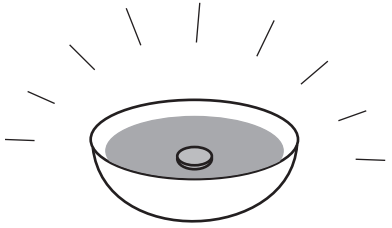


3. Ask a friend to pour some water in the bowl.

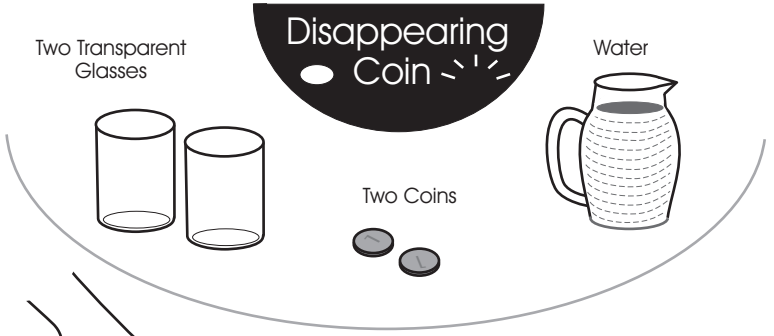


4. On adding water the whole coin will magically reappear and become visible!

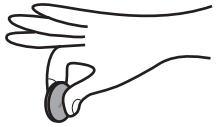
Light bends away from the normal as it goes from a denser medium to a lighter medium. This phenomenon is called Refraction.



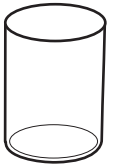
Disappearing Coin

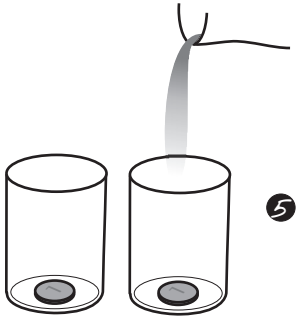


1. Place a glass on a coin.



2. Put the other coin inside the second glass.

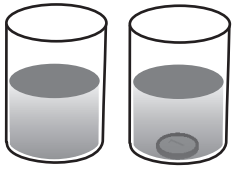


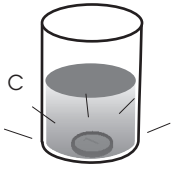


3. Fill both glasses with equal amounts of water.

4. On pouring water the coin underneath the first glass will disappear. The second coin will still be visible.

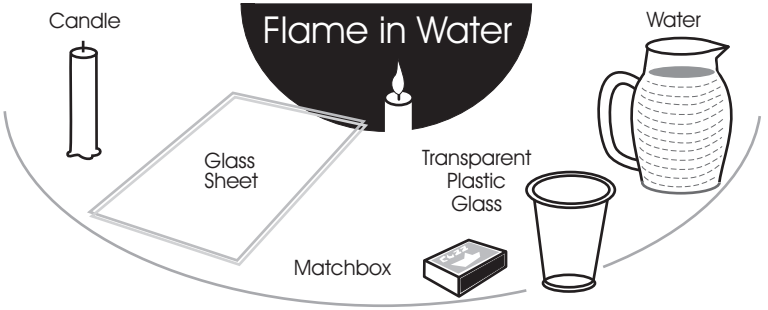
5. Now lift the first glass. Place a few drops of water on the coin before placing the glass back. Magically the coin will reappear!



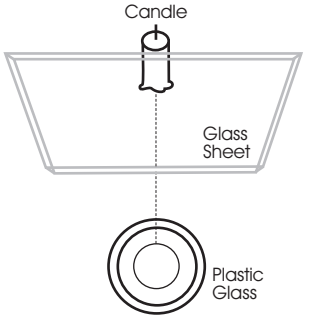


Water and glass have almost the same refrative index. So, when a water drop is placed on the coin as in (C), it simulates the conditions in (B) and the coin becomes visible.

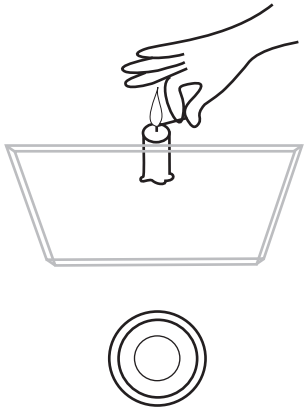
Flame in Water



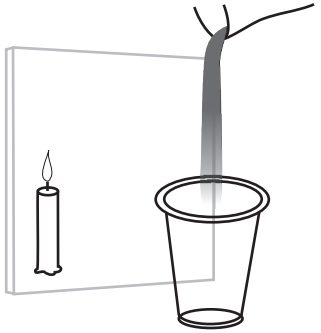
1. Stand the glass sheet vertically on a table. Place the candle and glass on either side of the glass sheet at an equal distance as shown.

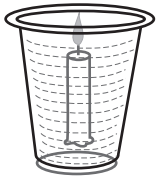


2. Now light the candle.



3. Then add water to the glass.

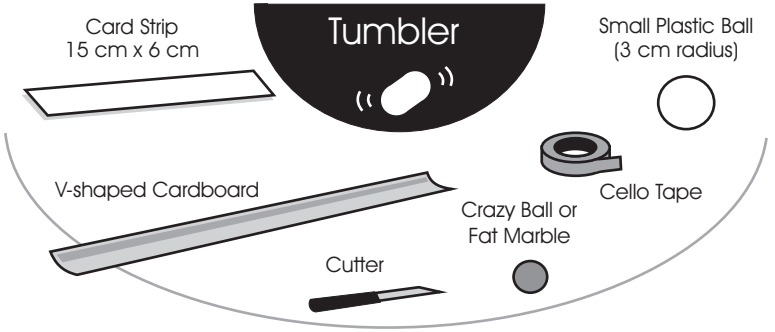




On looking through the glass sheet, the candle will appear to be burning inside the water glass.

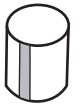
The reason for this magic is that the image of the burning candle superimposes itself on the water glass.

Tumbler



1. Cut the plastic ball in two equal halves.

2. Fold the card strip in a hoop which should fit into the cut ball.

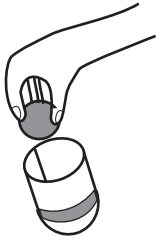


3. Tape the hoop and one half of the ball.

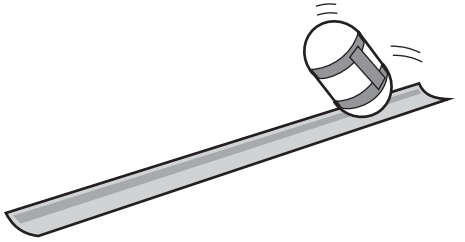
4. Drop a small crazy ball inside the hoop.

5. Now tape the second half of the ball to the hoop. This will complete the tumbler.

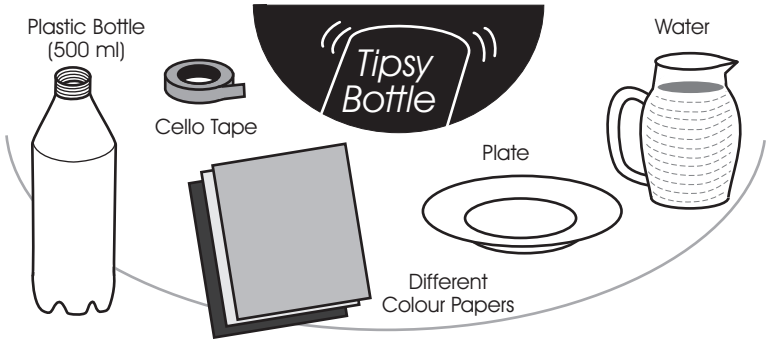
On tilting, the crazy ball shifts from right to left. This changes the centre of gravity of the capsule and it tumbles.

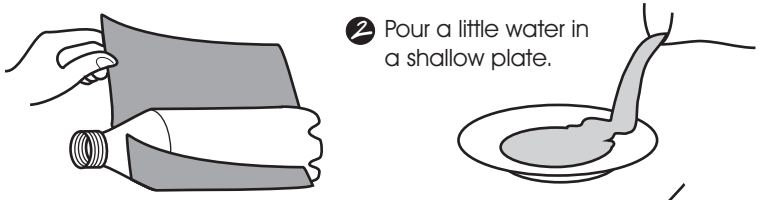


6. Place the tumbler on the V-shaped cardboard. Tilt it slightly to make it tumble down.



Tipsy Bottle

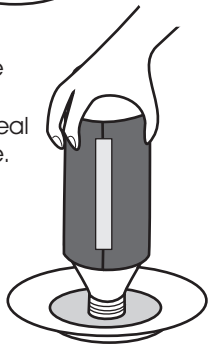




2 Pour a little water in a shallow plate.

1 Wrap and tape a plastic bottle in black paper.

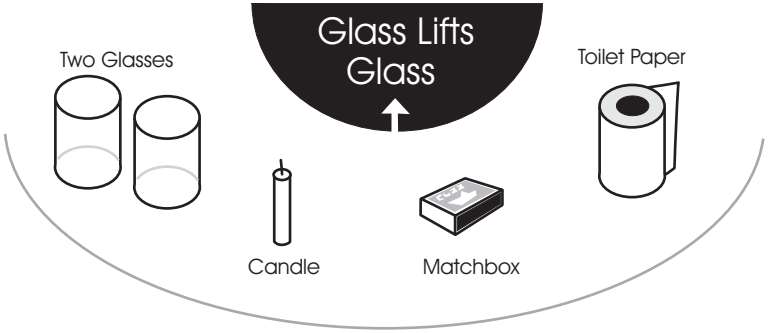
3 Stand the mouth of the bottle in the plate. The water in the plate will seal the mouth of the bottle.



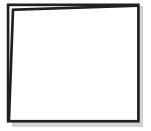
4 Place the whole assembly in the sun. After a while, the bottle will start shaking and air bubbles will exit from its mouth. Try this experiment with different colours of paper.

The black bottle will absorb the sun's heat. Air inside the bottle will expand and exit from its mouth.This will make the bottle shake and dance.

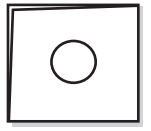
Glass Lifts Glass



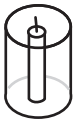
1 Fold the toilet paper in four layers.



2 Cut a 4 cm diameter hole in its centre.

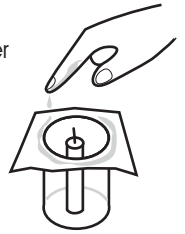


3 Fix a candle in one glass.



4 Place paper layers on the top of this glass.

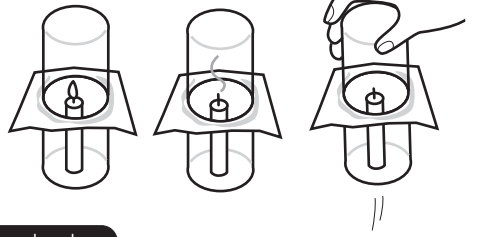
5 Wet the toilet paper around the rim.



6 Light the candle.

7 Wet the rim of the other glass...

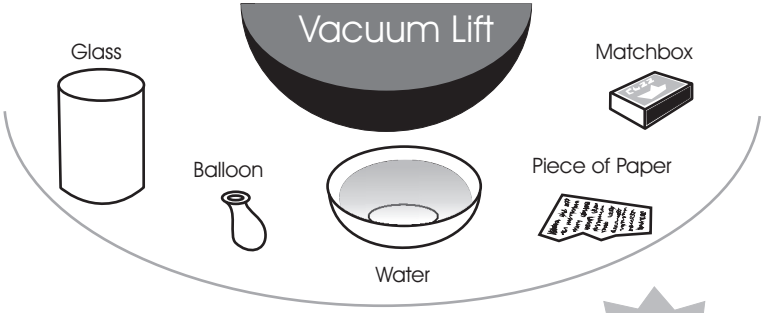
8 ... and invert it on the first glass. Wait until the candle extinguishes.



Hot air on cooling, contracts and creates a vacuum between the two glasses. The glasses stick and can be lifted together.

9 On lifting the top glass, the lower glass will also be raised.

Vacuum Lift

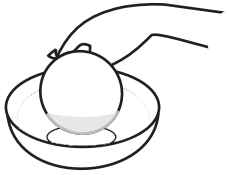


SEEK ADULT HELP

1. Blow a balloon and tie a knot.

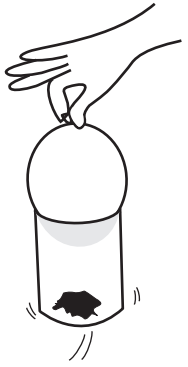
2. Burn a piece of paper.

3. Carefully drop the burning paper in an empty glass.



4. Dip the balloon base in water.

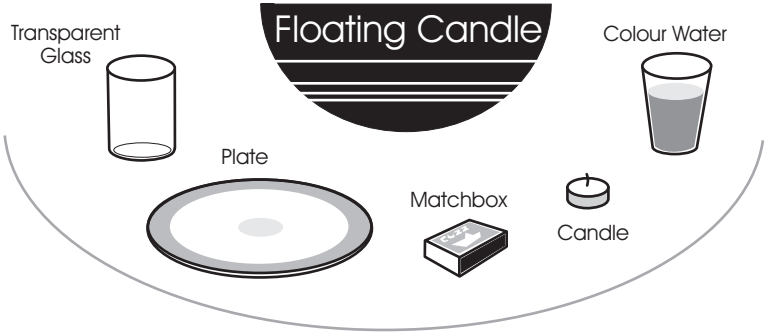
5. Place the wet balloon on the glass. Wait for the burning paper to extinguish. The balloon will now stick to the glass.



6. On lifting the balloon, the glass will lift along with it.

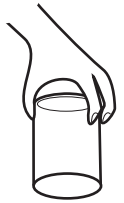
Hot air inside the glass after cooling will contract and will suck the balloon tightly in. This is the power of vacuum.

Floating Candle

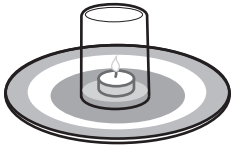


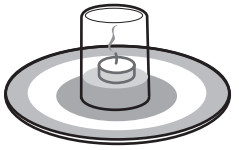
1. Pour colour water in a plate.

2. Place a lighted candle in the middle.



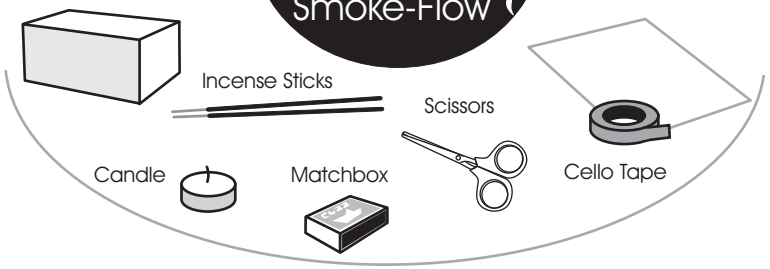
3. Cover the candle with a glass. In a little while, the candle will extingush and water will rise up vigorously. This will make the candle float.



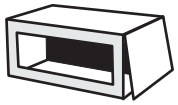


The hot air inside the glass contracts on cooling. Cool air will occupy less space and will vigorously suck the water from the plate.

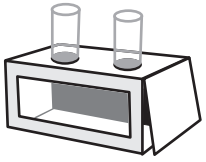
Convection Smoke-Flow



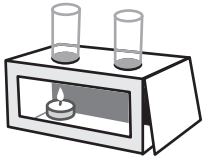
1. Cut a rectangular window in the box as shown.



2. Stick black paper inside the box. The black background will make the smoke visible.

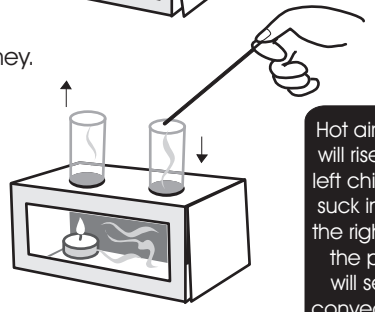


3. Make two cylinders from a transparency and fix them tightly in the holes.



4. Place a lighted candle below the left chimney inside the box.

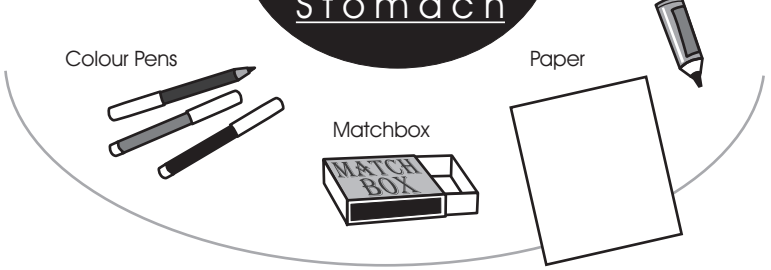
5. Light an incense stick and hold it on the right chimney.



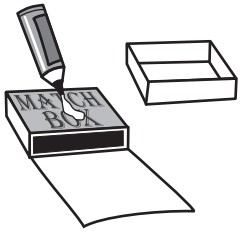
6. The incense smoke will be sucked in from the right chimney and will exit from the left chimney.

Hot air being lighter will rise up from the left chimney. This will suck in smoke from the right chimney. In the process, you will see beautiful convection currents.

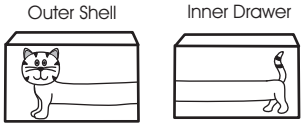
Stretchable Stomach



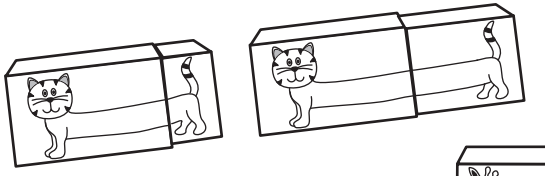
1. Cover the outer shell of the matchbox with white paper. Also cover the base of the drawer with white paper.



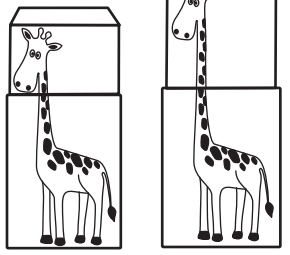
2. Draw a cat's face and half body on the matchbox shell. Draw the tail end on the drawer. Remember to make a long stomach.



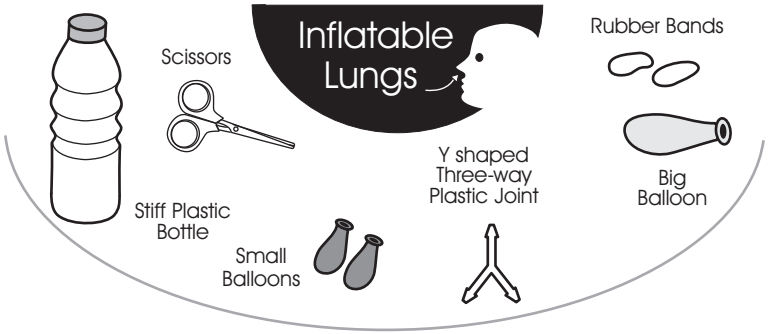
3. On pushing the drawer inwards the stomach will contract. On pulling it out, the cat's stomach will stretch.



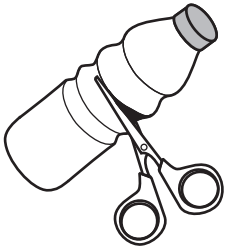
4. Similarly, draw a giraffe on the shell and drawer. The giraffe's neck can be elongated by pulling the drawer out of the shell.



Inflatable Lungs



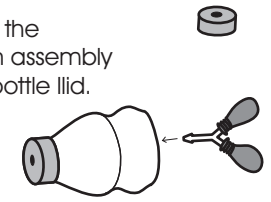
1. Cut the bottle 12 cm from the top.



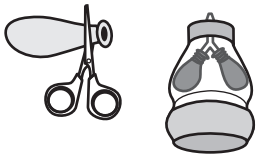
2. Attach two small balloons as lungs to the Y shaped joint with rubber bands.

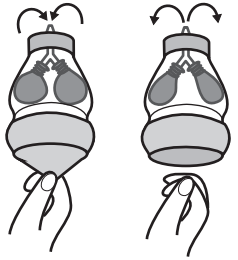
3. Make a small hole in the bottle lid.

4. Press fit the balloon assembly in the bottle llid.



5. Cut a good quality big balloon. Stretch and fix it on the open end of the bottle like a diaphragm.

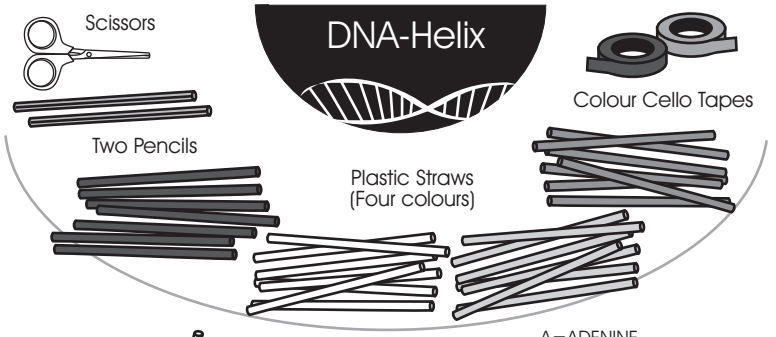




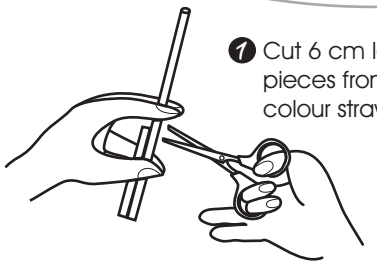
6. On pulling the balloon diaphragm down both the small balloons will inflate - filling both lungs with air. On releasing the diaphragm the lungs will deflate.

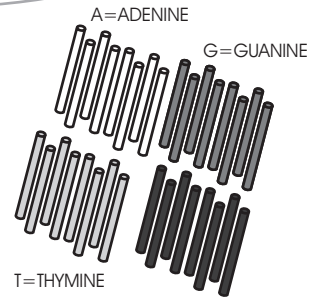
This wonderful model graphically demonstrates the functioning of our lungs.

DNA-Helix

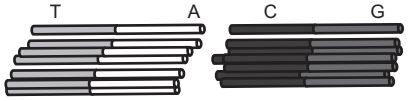


1. Cut 6 cm long pieces from colour straws.



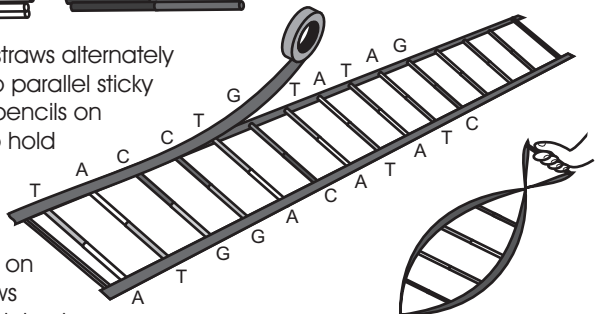


2. Tape straws of two different colours.



3. Stick colour straws alternately between two parallel sticky tapes. Stick pencils on both ends to hold the model.

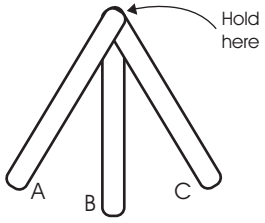
4. Stick another layer of tape on top. The straws will be sandwiched between two layers of tape.



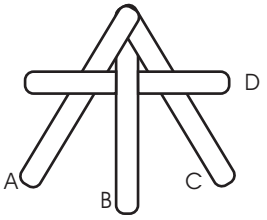
5. Hold the model on both ends and twist it to see a beautiful DNA HELIX.

DNA, a short for Deoxyribonucleic Acid, is heriditary material inherited by children from their parents. Because of this blueprint children share traits with their parents, such as skin and eye colour.

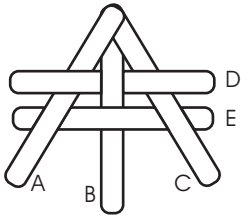
Peace Bomb



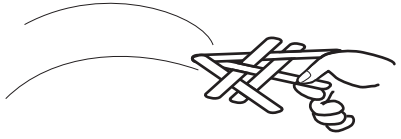
1. Hold three ice-cream sticks, A, B and C together at one end with B at the bottom. Spread A and C as shown.



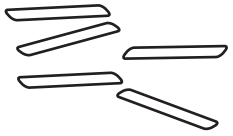
2. Insert a fourth stick D, over A, under B and over C as shown.



3. Insert the last stick, E under A, over B, and under C as shown. The assembly of 5 ice-cream sticks will hold itself together.



Five ice-cream sticks can be arranged in this manner, so that they hold together without any glue or staples. On impact the sticks come loose and fall apart!



4. Try throwing it up in the air or against a wall. When it lands, the bomb will "explode" and the sticks will fly in all directions.